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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/414,526	10/08/1999	YEONG-KWAN KIM	SEC.637	3413
20987	7590	11/18/2004		
VOLENTINE FRANCOS, & WHITT PLLC ONE FREEDOM SQUARE 11951 FREEDOM DRIVE SUITE 1260 RESTON, VA 20190			EXAMINER CLEVELAND, MICHAEL B	
			ART UNIT	PAPER NUMBER
			1762	

DATE MAILED: 11/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

**Application No.**

09/414,526

**Applicant(s)**KIM ET AL. *TH***Examiner**

Michael Cleveland

**Art Unit**

1762

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 29 September 2004.  
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 15-27 is/are pending in the application.  
4a) Of the above claim(s) 20 and 26 is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 15-19, 21-25, and 27 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.  
10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Election/Restriction*

1. Claims 20 and 26 are withdrawn from consideration as being directed to a non-elected species. See 37 CFR 1.142(b) and MPEP § 821.03.

### *Claim Rejections - 35 USC § 112*

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 15-19, 21-25, and 27 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. There is no disclosure that demonstrates that Applicant had possession of all combinations in the claimed method of an oxygen gas, a first reactant, and a second reactant, wherein the reactants are different from the oxygen gas.

### *Claim Rejections - 35 USC § 103*

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 15-18 and 21-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. (Appl. Phys. Lett., **71**, pp. 3604-3606, hereafter Kim) in view of Yun et al. (U.S. Patent 6,447,908, hereafter '908) and Soininen (U.S. Patent 5,496,597, hereafter '597).

Claims 15, 17-18, 25, and 27: Kim teaches an atomic layer deposition (ALD) reaction loading a silicon substrate into a reaction chamber, dosing with TMA, which inherently chemisorbs to the surface, purging with argon, which inherently removes any physisorbed TMA,

injecting (flushing with) water to react with the TMA to form an alumina film, and repeating the dosing, purging, and injecting steps to build an alumina film (p. 3604). The substrate is held at 370 °C.

Kim does not teach flushing the surface of the substrate with oxygen to uniformly terminate the surface with oxygen.

Yun '908 teaches the standard features of ALD, in which reactant vapors are alternately pulsed onto a substrate. Yun does not attribute any advantage to the order of the reactants. Further, it has been held that the selection of any order of performing process steps is *prima facie* obvious in the absence of new or unexpected results; *In re Burhans*, 154 F.2d 690, 69 USPQ 330 (CCPA 1946).

Soininen '597 teaches that oxygen may be used instead of water as the reactant in ALD reactions to deposit metal oxide films, such as alumina (col. 13, lines 23-29). The selection of something based on its known suitability for its intended use has been held to support a *prima facie* case of obviousness. *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). See MPEP 2144.07.

Therefore, taking the references as a whole, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have use oxygen instead of water as the oxygen precursor because '597 teaches that oxygen is operative as the oxygen precursor during ALD of metal oxide films and it would have been obvious to one of ordinary skill in the art at the time the invention was made deposited the metallorganic precursor (TMA) and oxygen in either order because it has been held that any order of performing process steps is *prima facie* obvious in the absence of new or unexpected results.

Flowing oxygen as the first reactant onto the silicon film would necessarily have uniformly terminated the substrate with oxygen atoms, as disclosed by Applicant (p. 6, lines 10-17).

The selection of something based on its known suitability for its intended use has been held to support a *prima facie* case of obviousness. *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). See MPEP 2144.07. The art recognizes both water and oxygen as suitable oxygen precursors for forming metal oxide films as discussed above. Therefore, for each oxygen precursor pulse, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have chosen the precursor from oxygen or water with a reasonable expectation of success because both are disclosed as suitable oxygen precursors for ALD of metal oxides. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used, for instance, oxygen as the first oxygen

precursor pulse and water for the remaining oxygen precursor pulses with a reasonable expectation of success because both oxygen and water are recognized as suitable oxygen precursors.

Claim 16: The purging steps inherently remove physisorbed material. (Applicant recognizes that the feature achieved by purging, for instance, at p. 11, lines 6-11).

Claim 21: Kim teaches that the substrate may be cleaned of a native oxide before being loaded into the chamber, but does not explicitly state that the cleaning step comes before loading the substrate into the chamber. However, it appears that it would have been obvious to one of ordinary skill in the art at the time the invention was made to have provided the cleaning step before loading the substrate into the ALD chamber in order to avoid damage to and contaminants in the ALD chamber by the HF used in the cleaning process.

Claim 22-23: A final purge inherently removes the by-products and any intermediates of the reaction (p. 3604, col. 2). Methane ( $\text{CH}_4$ ) is a by-product of the reaction (p. 3604, col. 1).

Claim 24: The step of introducing oxygen must occur for finite period of time, and therefore that period can be subdivided into the first half of the time, during which oxygen is introduced the first time, and the second half of the time, during which oxygen is introduced a second time.

6. Claims 19 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim in view of Yun '908 and Soininen '597 as applied to claim 15 above, and further in view of Comizzoli et al. (U.S. Patent 5,851,849, hereafter '849).

Kim, '579, and '996 suggest the formation of an alumina film by ALE, but do not explicitly teach the formation of other oxide films.

'849 teaches that other oxide films than alumina, such as  $\text{TiO}_2$ , may be formed by ALE using other metal precursors (col. 7, lines 1-42).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the method of Kim, '579, and '751 to have formed a film of a different metal oxide, such as titania with a reasonable expectation of success because '849 teaches that the process can be adapted to other metal oxides, and indicates that those metal oxides are of interest as passivating films.

Claim 27: '849 further teaches that ALD of alumina may take place at reaction temperatures of about 300 °C (col. 6, lines 11-24).

***Response to Arguments***

7. Applicant's arguments filed 2/5/2004 have been fully considered but they are not persuasive.

Applicants argue that Yun does not teach reversing the order of the reactants. The argument is unconvincing because the selection of any order of performing process steps is *prima facie* obvious in the absence of new or unexpected results; *In re Burhans*, 154 F.2d 690, 69 USPQ 330 (CCPA 1946). Yun is cited merely as demonstration that no criticality is expected from the order of ALD precursors.

Applicant argues that Kim teaches the removal of a native oxide and that such suggests away from the use of water or oxygen as the first reactant. The argument is unconvincing because the use of water or oxygen as the first reactant of the ALD process would not lead to a native oxide film, but to an approximate monolayer of adsorbed oxygen or water prepared to react with the metallorganic precursor.

Applicant argues that the amendments overcome the examiner's argument regarding claim 15. However, it does not overcome the argument made regarding claim 18 over the same references that for each oxygen precursor pulse, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have chosen the precursor from oxygen or water with a reasonable expectation of success because both are disclosed as suitable oxygen precursors for ALD of metal oxides. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used, for instance, oxygen as the first oxygen precursor pulse and water for the remaining oxygen precursor pulses with a reasonable expectation of success because both oxygen and water are recognized as suitable oxygen precursors.

Insofar as Applicant questions the motivation of such modification, the selection of something based on its known suitability for its intended use has been held to support a *prima facie* case of obviousness. *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). See MPEP 2144.07.

***Conclusion***

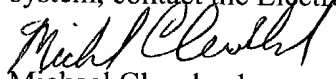
8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Cleveland whose telephone number is (571) 272-1418. The examiner can normally be reached on Tuesday-Friday and alternate Mon, 8-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (571) 272-1415. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
Michael Cleveland  
Patent Examiner  
November 16, 2004